

and Crawford counties, Wis., land badly washed and some crops lodged beyond recovery; in Kosciusko and Allen counties, northern Indiana, streams high, country flooded; in Auglaise valley, Ohio, destructive floods. 15th, Illinois Central railroad, two bridges carried away in northern Illinois. Neillsville, Wis., 20th, the recent rains made a 6 foot rise in Black river, logs running good. 21st, New Orleans, streets flooded 3 to 4 feet deep. 22nd, Silver Lake, Dak., forty miles north of Yankton, cloudburst, submerging country and drowning seven persons; west branch of Vermillion river spread out to a width of over one mile, and 10 to 30 feet deep. 28th, Missisquoi and other streams near Richford, Vt., much swollen; southwestern railroad track badly washed; trains delayed.

*Drought.*—Gainesville, Ga., severe drought from 6th to 27th; no rain; crops half destroyed. Somerset, Mass., very severe and injurious. Frankford, Mo., no rain of any amount has fallen within eighteen miles of this station; vegetation seriously injured by drought; early corn entirely cut short, later crops much damaged and some completely ruined. Greenville, N. C., month very dry; no rain from the 4th to 28th. Near Cleaveland, Tenn., vegetation suffering severely for want of rain; 21st, severe drought, everything drying up; 26th, very dry, vegetation parched; 27th, hottest and driest weather ever seen in the state. Wytheville, Va., 13th, drought fairly commenced; corn in fields curling and suffering; garden vegetables suffering still more; flowers entirely destroyed in large numbers where watering was impossible; no rain from 1st to 17th. Crops on Long Island suffering from drought, 7th. Dorchester Co., Md., rain much needed, pastures failing, corn suffering, 19th.

*Hail.*—Ft. Wallace, Kan., 28th; Camp Sheridan, Neb., 7th; Ft. Sanders, Wy. Ter., 6th, 10th; Summit, Col., 5th, 11th, 13th, 16th, 21st, 25th, 27th; Byron, Ia., 31st; Vail, Ia., 10th; Independence, Ia., 31st; Tabor, Ia., 25th, 28th, 30th, 31st; Sandy Springs, Md., 31st; Amherst, Mass., 21st; Fall River, Mass., 21st; De Soto, Neb., 31st; Clear Creek, Neb., 10th; Near Genoa, Neb., 8th; Scarsdale, N. Y., 21st; Starkey, N. Y., 10th; South Hartford, N. Y., 16th, 21st, 26th; Near Chambersburg, Pa., 12th; Catawissa, Pa., 18th, 21st; Kit Carson, Col., 9th; Salt Lake City, Utah, 15th; Winnemucca, Nev., 23rd; Denver, Col., 28th; Cheyenne, Wy. Ty., 27th; Detroit, Mich., 31st; Charleston, S. C., 14th; Washington, D. C., 19th.

*Rainy Days.*—The number of days on which rain has fallen varies as follows: New England, 7 to 15; Middle States, 7 to 15; South Atlantic States, 8 to 15; Gulf States, 7 to 18; Ohio valley and Tennessee, 9 to 16; Lower Lake region, 9 to 18; Upper Lake region, 9 to 15; Upper Mississippi valley, 6 to 16; Lower Missouri valley, 6 to 14; Eastern slope, 5 to 16; Rocky Mountain stations, 7 to 18; Western plateau, 1 to 4; Pacific coast, 0 to 6.

*Cloudy Days.*—New England, 5 to 14; Middle States, 3 to 11; South Atlantic States, 3 to 9; Gulf States, 1 to 10; Ohio valley and Tennessee, 5 to 12; Lower Lake region, 5 to 11; Upper Lake region, 5 to 11; Upper Mississippi valley, 3 to 10; Lower Missouri valley, 7 to 10; Eastern slope, 3 to 7; Rocky Mountain stations, 0 to 5; Western plateau, 1 to 4; Pacific coast, 0 to 11.

*Snow.*—Summit, Col., 27th, snow fell thickly at the station, covering all the surrounding summits.

## RELATIVE HUMIDITY.

The average percentage of relative humidity for the month ranges as follows: New England, 62 to 83; Middle States, 62 to 84; South Atlantic States, 67 to 83; Gulf States, 65 to 81; Ohio valley and Tennessee, 63 to 72; Lower Lakes, 68 to 74; Upper Lakes, 66 to 77; Upper Mississippi valley, 63 to 75; Lower Missouri valley, 63 to 71; Eastern slope, 59 to 75; Western plateau, 13 to 34; Pacific coast, 32 to 78. High stations report as follows: Mt. Washington, 97.6; Virginia City, 36.9; Cheyenne, 52.1; Denver, 46.2; Colorado Springs, 54; Santa Fe, 40.4.

## WINDS.

The prevailing winds at the Signal Service stations are shown by the arrows, flying with the wind, on chart No. II. The *maximum* velocities, in miles per hour, have been given in the description of the movements of areas of low pressure. On Mt. Washington the highest velocity, NW. 100 miles, was recorded on the 27th.

*Total Movements of the Air.*—The following are the *largest* monthly movements recorded at the Signal Service stations, viz.: Mt. Washington, 17,600 miles; Cape Lookout, 12,940; North Platte, 10,569; Cape Hatteras, 10,296; Portsmouth, N. C., 10,226; Dodge City, 9,285; San Francisco, 9,183; Stockton, Tex., 8,862; Cape May, 8,692. The *smallest* are: Montgomery, 1,614 miles; Knoxville, 1,803; San Antonio, 2,092; Lynchburg, 2,180; Shreveport, 2,260; Visalia, 2,277; Nashville, 2,462; Dubuque, 2,626; Graham, Tex., 2,693; Roseburg, Or., 2,716; Vicksburg, 2,708. Lieut.-Commander Chas. H. Craven, U. S. Navy, observer at U. S. Navy Yard, Mare Island, Cal., remarks: "I think it worthy of special remark the following record of the average force of the winds of this first half of *June*. \* \* \* Average wind per hour is 17.42 miles. According to the oldest inhabitants it has been unprecedented. From 4:36 a. m., 11th to 12th, an average of 26.4 miles per hour. At 5 p. m., 6th, SW. 62 miles; at 5:30 p. m., 11th, SSW. 56 miles; at 9 p. m., 14th, WSW. 45 miles;" "also total movement of the wind for July, 13,548 miles."

*Local Storms.*—Rowe, Mass., 4th, heavy rain, doing considerable damage. Camp Sheridan, Neb., 7th, 4.07 to 4.16 p. m., severe thunder-storm from the east, with hail stones covering the ground like snow, largest

measuring seven inches in circumference and the smallest six; the heaviest weighed after the storm  $1\frac{1}{2}$  oz; 640 panes of glass broken at the post, chickens killed, corn and vegetables cut down. Boone Co., Iowa, 8th, storm of rain and hail, causing almost total destruction of crops. St. Thomas, West Indies, 9th and 10th, heavy rains, strong winds, almost a hurricane. Oregon, Mo., 9th, 4 a. m., strong gale from NW., with thunder and lightning, destroying crops, trees, buildings, &c. From 10th to 12th, severe rains in northeastern portion of Iowa, much damage to crops. Chambersburg, Pa., 12th, heavy storm of wind and rain; six miles southwest, very destructive hail-storm. During the night, (11th and 12th,) a severe NE. gale prevailed at the mouth of St. John's River, Fla.; Schr. Sarah R. Thomas broke loose at 11:30 p. m., and after crossing bar went ashore at daylight south of Mayport; at Mayport a very high sea prevailed during morning, and two pilot boats were landed high and dry. At St. Augustine, Fla., p. m. 11th to 7 a. m. 12th, NE. to SE. gale. At Abaco, Bahamas, evening 11th, NE. gale. 14th, Charleston, S. C., severe thunder and hail-storm from 1 p. m. to 2:15 p. m.; rainfall from 1 to 2 p. m. 4 in., and from 2 to 4:30 p. m. 1.13 in., total 5.13 in.; hail at 1:30 p. m. very heavy in low portion of city; wind constantly veering and backing between NE. and SW. by the SE.; max. vel., S. 42 at 1:40 p. m.; in Meeting street seven inches of rain is reported to have fallen in 15 minutes, and the streets in this portion of city were flooded over three feet deep; buildings, shipping, and trees were considerably damaged by wind and lightning. At Tybee Island, Ga., 14th, a heavy NE. gale prevailed from 4:15 to 5 p. m. Scarsdale, N. Y., 21st, severe gale, with hail, uprooting trees and destroying vegetation. Near Cleveland, Tenn., 31st, heavy wind-storm six miles north of station, peach orchards severely injured.

*Waterspouts.*—June 4th, Denver, Col., water-spout observed up Platte Canyon, about ten miles to the southwest; visible about ten minutes; most damage occurred in vicinity of Littleton; Platte river raised slightly and inundated a portion of railroad track. June 24th, Indianola, at 7:10 a. m., two large waterspouts were observed about three or four miles southeast of station, moving northward over the bay, at about twelve or fifteen miles per hour; they appeared about two or three miles apart; the columns were complete from surface of bay to the clouds and broke up respectively at 7:25 and 7:35 a. m. Mayport, Fla., July 24th, eight miles NE. of station; no progressive motion visible.

## VERIFICATIONS.

*Indications.*—As worked up and issued to the public three times daily, they have been carefully compared with the actual conditions during the succeeding twenty-four hours, with the following result:—the percentage verified averages 80.6 for New England; 77.8, Middle Atlantic States; 83.5, South Atlantic States; 89.8, Eastern Gulf States; 86.7, Western Gulf States; 81.6, Ohio Valley and Tennessee; 84.9, Lower Lake region; 83.1, Upper Lake region; 84.3, Upper Mississippi valley; 82.9, Lower Missouri valley. For all the districts the average verified is 83.7 per cent. By elements the percentage verified averages 86.1 for the weather; 86.8, wind-direction; 81.1, temperature; 80.9, barometer. There were 23 omissions to predict, (8 for weather, 4 for wind-direction, 5 for temperature and 6 for barometer,) out of 3,720, or 0.62 per cent. Of the predictions made, 3.0 per cent are recorded as having completely failed; 3.0 per cent, as one-fourth verified; 14.3 per cent, as one-half verified; 15.3 per cent, as three-fourths verified; 64.4 per cent, as fully verified.

*Cautionary Signals.*—During the month 88 Cautionary Signals were displayed; 67, or 76 per cent., were justified by subsequent hourly velocities of 25 miles or over, at or within 100 miles of the station. Two signals were ordered up late. Sixty-three cases were reported, generally from scattered stations, of winds of 25 miles or over when signals were not ordered.

## NAVIGATION.

*Stages of Water in Rivers.*—In the table, upon the right side of chart No. III, are given the highest and lowest readings of the Signal Service gauges for the month, with the dates. Generally, the changes in the rivers have been gradual and slight. The Cumberland rose three feet on the 2nd and 3rd at Nashville. The Ohio rose 3 feet 5 inches the 18th and 19th at Cincinnati. In the Lower Missouri and Lower Mississippi there has been almost a steady fall throughout the month. The Upper Mississippi rose nearly 4 feet at Dubuque from the 11th to the 13th; over 4 feet at Davenport from the 13th to the 16th; nearly 3 feet at Keokuk from the 14th to the 17th; over 3 feet at St. Louis on the 30th and 31st. At Omaha the channel of river changed during month towards Nebraska shore and is now between piers Nos. 3 and 5. Fort Gibson, 16th, steamer Big Rock arrived from Little Rock, being the first arrival in eight years. Shreveport, navigation good throughout month for largest class of boats. La Crosse, 13th, "water getting so low that navigation is exceedingly difficult." Dubuque, a good boating and rafting stage during month. Savannah river, at Augusta, Ga., 27th, lower than since 1876, forded by man on horseback.

## ATMOSPHERIC ELECTRICITY.

*Thunder-storms.*—1st, Ill., Ind., Mich., Mo., Ohio, Tenn., Tex., Miss., Fla., Ga., S. C. 2nd, Tenn., Va., Ind., N. Y., Ohio, Ga., Va. 3rd, Me., Miss., N. Y., Montana, Mich., W. Va., Ga., Va., Me., Dak., Ohio, S. C. 4th, Conn., Kan., Mass., N. J., N. Y., Pa., Tex., Fla., La., Mo., W. Va., Ga., Utah. 5th, Ill., Kan., Va., Col., Tex., Fla., Ga., Mo., Utah. 6th, Ala., Ill., Mo., Ohio, Tenn., Va., Ind., Nebr., Dak., Tex., Miss.,